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Research Article
Strategic Management of Working Capital Components to Firm Profitability: Dual-Model Approach

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Abstract

Background and Objective: This study delves into the critical role of working capital management in profit-oriented manufacturing firms, aiming to address gaps in understanding its association with profitability, particularly in the U.S. context. Through a comprehensive examination, it seeks to enrich knowledge on the intricate relationship between working capital management and Return on Capital Employed (ROCE), providing valuable insights for both practitioners and researchers. **Materials and Methods:** The SEC EDGAR data of manufacturing firms, from the pre-pandemic (2019), pandemic (2020) and post-pandemic (2021) periods, were analyzed through a dual-model approach using Time Series Ordinary Least Square Regression and Spearman Correlation statistical analysis to advance existing theories, namely: Pecking-order and trade-off theories. **Results:** This study revealed stable patterns in account payable and inventory turnover, contrasting with increased variability in account receivable turnover and ROCE, particularly during the pandemic. The Post-pandemic, ROCE recovery aligns with pecking order and trade-off theories, indicating improved profitability and a nuanced balance in internal fund usage. Regression models reveal positive correlations, challenging the pecking order theory. Economic disruptions impact conservative and aggressive strategies, emphasizing the need for adaptive WCM. **Conclusion:** This study enhances the discourse surrounding the intricate interplay between WCM and firm profitability, emphasizing the significance of adaptive strategies in response to economic disruptions.

Key words: Working capital management, firm profitability, pecking-order theory, trade-off theory

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INTRODUCTION

Undoubtedly, the strategic management of working capital is the lifeblood of a firm. Working capital, a capacity to oversee liquidity and facilitate the settlement of debts and obligations, is crucial for profit-oriented manufacturing firms. Proper working capital management is paramount for determining firm value and ensuring effective financial performance[1-5]. Inadequate exploration of the association between working capital management and corporate profitability has resulted in manufacturing firms' failures. In response to crisis such as the 2008 financial crisis or pandemic, U.S. manufacturing firms shifted their attention towards enhancing working capital to bolster profitability. Despite these efforts, the profitability of numerous U.S. manufacturing firms has persisted in declining, primarily attributed to ineffective working capital management. Ineffective working capital management is the failure to effectively manage components of working capital management such as inventory and account payable. An effectively managed manufacturing firm working capital enables firms to redirect unused resources or capital to areas where they can maximize profits[6].

Profitability serves as a crucial metric, representing a firm's capacity to generate earnings surpassing its obligations, aligning with the principal objective of profit-centric manufacturing firms to optimize returns from invested capital[2,7-9]. As posited by Girma[10], firms striving to maximize their value endeavor to maintain an optimal working capital level while carefully assessing the trade-off between the risks associated with altering working capital levels and the expected profitability. Research by Louw *et al.*[11] and Maeenuddin *et al.*[12] reveals that various components of working capital exert similar or different influence on manufacturing firms' profitability. External events, such as the COVID-19 pandemic, could further highlight the significant impact on the relationship between working capital management and firm profitability in the manufacturing sector[13-17].

In the context of the U.S. economy, the manufacturing sector, comprising manufacturing firms, plays a pivotal role, providing valuable insights for investors, regulators, strategists, academia and researchers[18]. Studies indicate that U.S. manufacturing firms leverage working capital management and resource development to enhance their survival rates[19]. Effective working capital management is underscored by Prempeh and Peprah-Amankona[20] as crucial for manufacturing firms, given that its components constitute a substantial portion of their assets. Strategic management of inventory, accounts payable and accounts receivables has been shown to be vital for achieving effective working capital management and consequently, impacting firm profitability[21,22].

Nwude *et al.*[5] identify ineffective working capital management as a primary cause of business failure globally. The most successful and profitable firms in the manufacturing sector are those that effectively manage their working capital[23,24]. Firms can increase their ROCE and attain high profitability through working capital management[12,25]. Strategies preventing business failure involve leveraging working capital to enhance cash flows, reduce reliance on external capital, lower the cost of debt and ultimately enhance profitability[26-30]. Enhanced profitability contributes to the financial value perceived by investors[31,32].

Two distinct approaches to working capital management, namely dynamic and static approaches, influence firms' strategies[33,34]. In the United States, firms typically adopt a static approach to maintain a minimum working capital level to support planned sales, while the dynamic approach is often use for adaptation to changes in demand resulting from external factors[33,35]. Firms' choice between dynamic and static approaches hinges on the desired level of flexibility, with the dynamic approach offering greater adaptability compared to the more rigid static approach[33].

Firms commonly employ three distinct working capital management strategies-conservative, hedging and aggressive which align with the two aforementioned approaches[1,4,32,33,35]. Additionally, these strategies, often used for financing, have been identified as influencing working capital[3,36]. The literature emphasizes that a firm's selection of a working capital management strategy significantly impacts its profitability[37,38]. These strategies are integral to a firm's daily operations, encompassing both operational and financing aspects[34,37,38], providing frameworks for managing current assets and liabilities.

Numerous studies have delved into the relationship between working capital management and firm profitability in global manufacturing sectors, with similar research conducted in the U.S. manufacturing sector[8,29,39-44]. Sector-specific analysis demonstrates that external events can impact this relationship differently[45], attributed to varying availability of working capital management components across sectors[11,12,14,46]. The dynamic relationship, particularly with ROCE, undergoes fluctuations amidst economic activities, warranting focus on the manufacturing sector due to the comprehensive presence of all working capital management

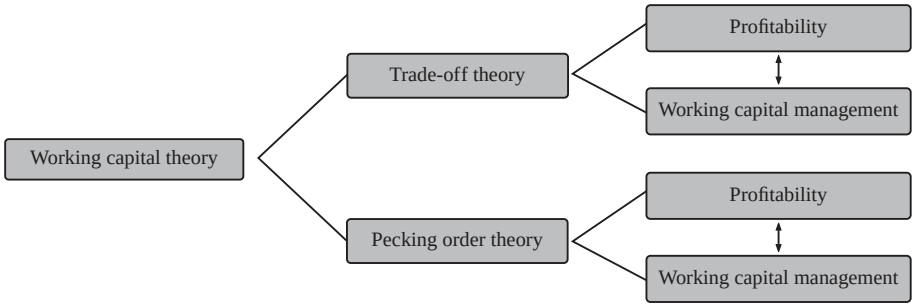

Fig. 1: Working capital theory

components[8,11-14,20,47-50]. Despite previous studies emphasizing the need to explore the impact of various components, particularly in the U.S. research gaps persist, notably concerning the influence of factors like strategy[12,14,33,51]. Understanding the critical interplay between working capital management components and ROCE, although addressed by a few studies, remains insufficient, with findings suggesting a significant association with inventory but inconsistent results for accounts payable and accounts receivable turnover[1,12,14,52,53]. To bridge these gaps, this study aims to contribute to existing knowledge, addressing literature suggestions for further research and providing insights valuable for both practitioners and researchers, building upon previous studies[12,52,53].

Working capital theory, shown in Fig. 1, is the theoretical framework of this study. The framework draws from the pecking order theory[54] and the trade-off theory[55], with the former positing that highly profitable firms maintain lower debt levels and rely on internal funds through effective working capital management, as evidenced by Myers[56] and further explored by Agyei *et al.*[57], Epong and Anom[58], Nguyen *et al.*[59] and Nyeadi *et al.*[60]. Concurrently, the trade-off theory, outlined by Oktavina and Manalu[55], suggests that a firm's working capital management positively influences its leverage and funding preferences. This theory is supported by Agyei *et al.*[57] and Nguyen *et al.*[59]. Asaolu[18] reinforces the notion that profitable firms tend to rely less on external financing for short-term obligations due to sufficient internal funds derived from effective working capital management. Aligning with Maeenuddin *et al.*[12] recommendation, this study adopts ROCE as a pertinent measure of profitability within the manufacturing sector, focusing on the call for broader geographical considerations. Maeenuddin *et al.*[12], Chambers and Cifter[27], Braimah *et al.*[51], Ren *et al.*[53] and Boisjoly *et al.*[61], emphasize the susceptibility of the relationship between working capital management and firm profitability to external influences, warranting examination across pre-pandemic, pandemic and post-pandemic periods.

The overall objective of this study is to enrich understanding of how U.S. manufacturing firms strategically manage their working capital components and how these strategies influence their profitability in various economic periods such as the pandemic. Through the analysis of SEC EDGAR data, spanning different time periods, the study aims to advance existing theories related to working capital management, such as the pecking-order and trade-off theories and to provide insights into the relationship between working capital management practices and firm profitability.

MATERIALS AND METHODS

In the pursuit of examining the relationship between the strategic management of working capital to ROCE, a comprehensive time series and spearman correlation analysis was conducted in the United States manufacturing sector using data from the pre-pandemic, pandemic and post-pandemic periods of 2019, 2020 and 2021, respectively. This section commences with an elucidation of the study area and data analysis procedure, offering insights to the analytical framework. The discussion further encompasses an overview of the variables under consideration, shedding light on the intricacies of the process. Lastly, the data collection process was articulated, providing a clear delineation of the focal point for this methodological endeavor.

Study area: Utilizing a quantitative methodology akin to that employed by researchers like Maeenuddin *et al.*[12], this study was conducted within the United States. Acknowledging Maeenuddin *et al.*[12] and Ren *et al.*[53] suggestion to incorporate external events during periods of economic activity into research on working capital management-ROCE relationship, this study considers a 12 month operating cycle as emphasized by Elberzhager *et al.*[33]. Furthermore, an evaluation of the strategic management of working capital in relation to ROCE across different economic cycles, spanning a three years period from 2019 to 2021 was conducted.

Data analysis procedure: The decision to concurrently apply two models for the data analysis procedure stems from the need to compare results and propel advancements beyond existing models. This dual-model approach enables a comprehensive exploration of the dataset, ensuring a more nuanced understanding of temporal dynamics and relationships among variables. By juxtaposing the outcomes of these two distinct models, the study strives to contribute valuable insights and refine existing methodologies in the realm of data analysis.

Time series Ordinary Least Squares (OLS) regression: To unravel the intricacies of the dataset, a robust analytical approach was employed grounded in Time Series OLS Regression. This method allows for a nuanced exploration of temporal patterns and relationships within the data. The model serves as a key tool for scrutinizing the dynamic interplay between working capital management components and ROCE across distinct time points. The standard representation of the OLS equation for a basic linear regression model as articulated by Moraffah *et al.*[62] is depicted in Eq. 1:

$$Y_i = \beta_0+\beta_1 X_i+\varepsilon_i \quad (1)$$

Where:

Y_i = Dependent variable (in this case, ROCE)
X_i = Independent variable (in this case, account receivable, account payable, or inventory)
β_0 = Intercept term, representing the value of Y when X is zero
β_1 = Slope coefficient, representing the change in Y for a one-unit change in X
ε_0 = Error term, representing the unobserved factors that affect but are not included in the model

The OLS regression equation for each research question would be:

- **RQ1:** Account receivable (AR) and ROCE (pre-pandemic period-2019):

$$ROCE_{2019} = \beta_0+ \beta_{AR\text{-}2019}AR_{2019}+\varepsilon_{2019} \quad (2)$$

- **RQ2:** Account payable (AP) and ROCE (Pre-pandemic Period-2019):

$$ROCE_{2019} = \beta_0+\beta_{AP\text{-}2019}AP_{2019}+\varepsilon_{2019} \quad (3)$$

- **RQ3:** Inventory (Inv) and ROCE (Pre-pandemic period-2019):

$$ROCE_{2019} = \beta_0+\beta_{Inv\text{-}2019}Inv_{2019}+\varepsilon_{2019} \quad (4)$$

- **RQ4:** AR and ROCE (pandemic period-2020):

$$ROCE_{2020} = \beta_0+\beta_{AR\text{-}2020}AR_{2020}+\varepsilon_{2020} \quad (5)$$

- **RQ5:** AP and ROCE (pandemic period-2020):

$$ROCE_{2020} = \beta_0+\beta_{AP\text{-}2020}AP_{2020}+\varepsilon_{2020} \quad (6)$$

- **RQ6:** Inv and ROCE (pandemic period-2020):

$$ROCE_{2020} = \beta_0+\beta_{Inv\text{-}2020}Inv_{2020}+\varepsilon_{2020} \quad (7)$$

- **RQ7:** AR and ROCE (post-pandemic period-2021):

$$ROCE_{2021}= \beta_0+\beta_{AR\text{-}2021}AR_{2021}+\varepsilon_{2021} \quad (8)$$

- **RQ8:** AP and ROCE (post-pandemic period-2021):

$$ROCE_{2021}= \beta_0+\beta_{AP\text{-}2021}AP_{2021}+\varepsilon_{2021} \quad (9)$$

- **RQ9:** Inv and ROCE (post-pandemic period-2021):

$$ROCE_{2021}= \beta_0+\beta_{Inv\text{-}2021}Inv_{2021}+\varepsilon_{2021} \quad (10)$$

In each case, from Eq. 2-10, represents the intercept, represents the slope coefficient for the respective variable and year and represents the error term for the respective year. The significance of will help determine if there is a statistically significant relationship.

Spearman correlation: The Spearman correlation method serves as a prevalent means of quantifying the relationship between two variables[21]. When working on real-life dataset, the application of the Spearman correlation coefficient becomes imperative. It enables an exploration of the degree of non-linear relationship, thereby enriching the analytical framework[63-65]. As highlighted by Sedgwick[64], the Spearman correlation coefficient typically ranges between -1 and +1, encompassing the spectrum of potential associations.

Concurrently with the implementation of Time Series OLS Regression, the Spearman Correlation analysis was integrated into the study's methodology. This non-parametric approach

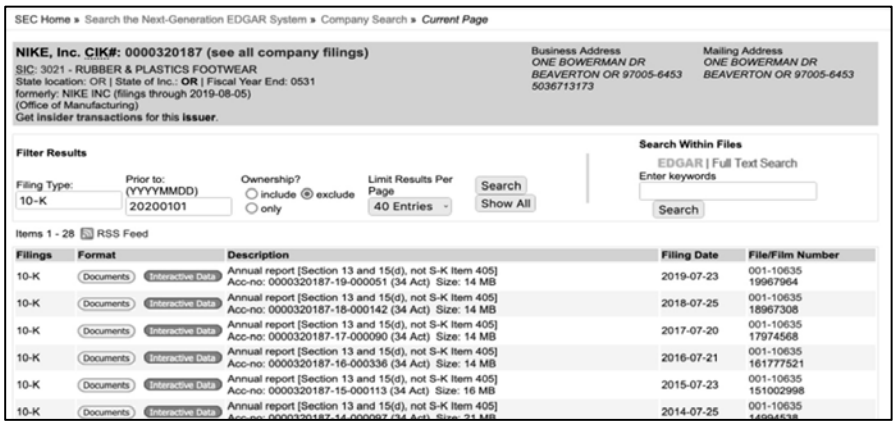

Fig. 2: Nike 10-K Sec EDGAR filings

Table 1: Variables definition and estimation monikers

Variable	Operational definition	Estimation moniker
Account receivable	Net sales divided by average account receivable[66]	Account receivable turnover (ART)
Account payable	Cost of goods sold divided by average account payable[67]	Account payable turnover (APT)
Inventory	Cost of goods sold divided by average inventory[67]	Inventory turnover (IT)
Return on capital employed	Earnings before interest and taxes divided by capital employed[69] Where capital employed = Total asset-Current liabilities	ROCE

facilitated the investigation of monotonic relationships among variables, serving as a valuable adjunct to the insights garnered from OLS Regression. By encompassing potential nonlinear associations that may evade linear modeling, the inclusion of Spearman Correlation analysis augmented the robustness and depth of the study.

Variables definition and estimation monikers: There are four variables in the study, namely: Accounts receivable, accounts payable, inventory and ROCE. Accounts receivable represent inventories that have been sold but have yet to generate cash inflows, resulting from credit sales[66]. Accounts payable, classified as a current liability, denotes credit extended to a business by its suppliers[67]. Inventory encompasses goods held for resale, those in the process of production, or items utilized as raw materials in the production process[67]. The ROCE reflects the profit derived from the capital employed[68]. Table 1 provides the operational definition and estimation moniker for the variables.

Data collection: For data acquisition, the study methodology employed a systematic six-step process. Initially, we identified the top 500 manufacturing firms through Industry week. Then 97 sample firms are selected randomly from this list to minimize potential biases. Following this, an access to the publicly available SEC EDGAR database was made. In the third step, the 10-K report for each selected firm was located within the SEC EDGAR database, as illustrated in Fig. 2. Once the reports were identified, each report is opened to capture key variables. In the subsequent two steps, the values for each variable of the firms were recorded and the systematic procedure was iteratively applied to all firms in the sample.

During the second and third procedural step, a query parameter underwent formulation and application using guidance from Singh[70]. To elucidate, the 10-K report for Nike pre-2020, utilizing the CIK number (an exclusive numerical designation assigned by the EDGAR database) denoted as 0000320187 was procured. In the query parameter, the CIK number and date parameter were adjusted. Following this refinement, an HTTPS request to access the entirety of 10-K reports was submitted for Nike during the specified date. This process culminated in the data collection process.

Data preparation: The initiation of the data preparation phase involved compiling an exhaustive list of the top 500 manufacturing firms by revenue, constituting the targeted sample for the year 2020, as sourced from IndustryWeek. Subsequently, within the Colab environment, a randomized selection of 97 firms was executed. Upon retrieving data across all periods for each firm from the SEC EDGAR database, the data was transferred into the Colab environment using the pandas' library read_csv function. To assess the presence of

duplicate datasets, the pandas duplicated() function was employed, returning false for all 97 sample firms, indicating an absence of duplicative datasets. Missing data were identified using the null().sum() function, across each economic period, with five missing values detected and attributable to factors such as firm bankruptcy or hostile takeovers. The firms with missing data points were excluded, resulting in a reduced sample size of 92 for each economic period. Outliers within the dataset spanning all economic periods, were identified. These outliers represent genuine data points inherent to the population. Given that the outliers identified in this study are authentic observations inherent to the population, firms that led to the outliers were retained within the dataset.

RESULTS AND DISCUSSION

This research study involved a dual-phase analytical approach, aiming to offer a comprehensive comprehension of the study. Two distinct types of analysis were applied. The initial phase involved descriptive or exploratory data analysis, providing a foundational exploration of key features within the dataset, including central tendencies, dispersion and overall structure. Subsequently, the study articulates the outcomes of our dual-model analysis, combining Time Series OLS Regression and Spearman Correlation. This methodical strategy enhances our exploration, allowing for a more nuanced interpretation of temporal dynamics and relationships within the dataset. The ensuing presentation of results seeks to contribute valuable insights to the existing scholarly landscape and further our understanding of the factors influencing the studied domain.

Descriptive analysis: Initially, a meticulous descriptive analysis was undertaken to characterize and summarize key features of the data. This phase laid the foundation for a detailed exploration of the dataset, offering insights into its central tendencies, dispersion and overall structure. The empirical results reveal a discernible downward trajectory in the turnover ratios of working capital management components and an unmistakable V-shaped pattern ROCE, as depicted in Fig. 3.

During the pre-pandemic period, an analysis of paired variables, including account payable turnover, account receivable turnover, inventory turnover and Return on Capital Employed (ROCE), was conducted on 92 firms. The firms exhibited an average (mean) account payable turnover of approximately 8.880 times, with a moderate variability (standard deviation of 6.866) and a range from slow (0.841) to rapid (51.310) payments. Similar variations were observed in account receivable turnover (mean of 154.808), inventory turnover (mean of 10.485) and ROCE (mean of 0.138).

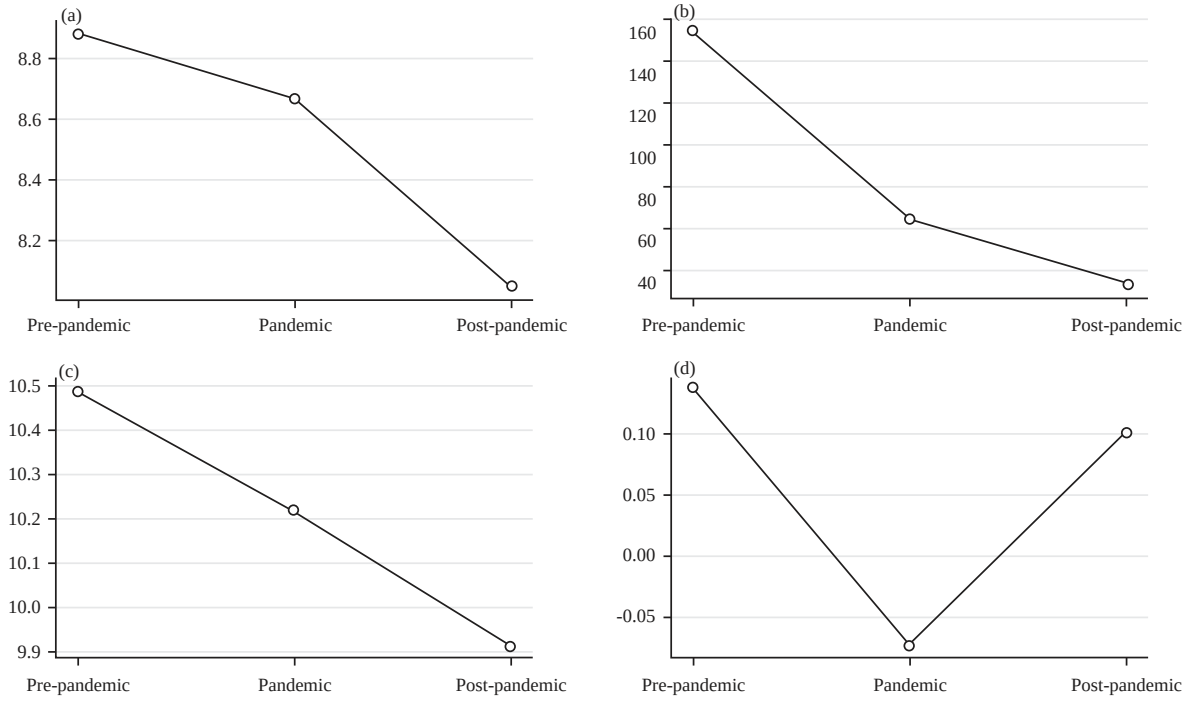

Fig. 3(a-d): Exploratory data analysis, (a) Account payable turnover, (b) Account receivable turnover, (c) Inventory turnover and (d) Return on Capital Employed (ROCE)

Table 2: Ordinary least square regression results

	Pre-pandemic		Pandemic		Post-pandemic	
Relationship	r	p	r	p	r	p
ART-ROCE	0.116	0.014	-0.078	0.472	0.077	0.000
AP-ROCE	0.083	0.001	-0.060	0.263	0.047	0.000
IT-ROCE	0.087	0.031	-0.072	0.467	0.071	0.000

r: Correlation coefficient and p: p-value

Transitioning to the pandemic period, the average account payable turnover remained notable at 8.666 times, with a moderate standard deviation of 5.716. The pandemic period, characterized by economic disruptions, saw a decrease in the average account receivable turnover to 64.552 times, with higher variability (standard deviation of 506.132). Inventory turnover and ROCE experienced similar trends.

In the post-pandemic period, the average account payable turnover decreased to 8.047 times, with relatively high variability (standard deviation of 6.426). The average account receivable turnover decreased to approximately 33.076 times, indicating a significant change in the firms' ability to collect outstanding payments compared to the pre-pandemic and pandemic periods. An average inventory turnover of approximately 9.915 times was seen during the post-pandemic era, indicating a slight decrease compared to the pre-pandemic era. Average ROCE for firms in the post-pandemic era was 0.101, indicating an average positive return on capital. This contrasts with the negative ROCE observed during the pandemic era, suggesting a recovery or adaptation of firms in the post-pandemic period.

The trends observed throughout all temporal epochs, as inferred from the descriptive statistics, indicate a degree of stability in both account payable turnover and inventory turnover. In contrast, account receivable turnover and ROCE manifest more pronounced fluctuations, notably during the pandemic era. Furthermore, the post-pandemic era exhibits discernible signs of recovery in ROCE, thereby implying a congruence with the tenets of both the pecking order theory and trade-off theory. This alignment is underscored by an amelioration in profitability, reflecting an intricate trade-off between the advantages derived from utilizing internal funds for investments and the concomitant costs associated with financial distress endured throughout the pandemic period.

In essence, the intricate dynamics between the diminishing trend observed in turnover ratios of working capital management components and the inverted-U pattern exhibited by ROCE underscore the multifaceted interplay among operational efficiency, working capital management and overall profitability. A deterioration in working capital efficiency is associated with a decline in profitability, as evidenced by the reduction in ROCE. Conversely, endeavors to optimize working capital efficiency can yield positive outcomes on profitability metrics, echoing the conclusions drawn by Awad and Jayya[71]. More recently, Maeenuddin *et al.*[12] identified a significant positive correlation between working capital management components and ROCE based on data spanning from 2007 to 2017. However, our preliminary data analysis challenges this assertion, revealing that the relationship may manifest either positively or negatively.

Dual-model analysis: Following the descriptive and exploratory data analysis, a dual-model analytical approach was explored, integrating Time Series OLS Regression and Spearman Correlation. This multifaceted strategic modeling approached provided the opportunity to delve deeper into the temporal dynamics and relationships present in the dataset. The juxtaposition of these two models provides a more nuanced and robust interpretation of the data, facilitating a comprehensive evaluation of both linear and non-linear associations among variables.

Time Series OLS Regression: In practical applications, real-world datasets frequently exhibit non-linear characteristics. To adhere to the linearity assumption essential for conducting a Time Series OLS Regression model, we executed a box-cox transformation on the dataset. This preprocessing step was undertaken to enhance the linearity and normality of the data, facilitating the appropriate application of the Time Series OLS Regression model in our analytical approach. The pandas, scipy and stats model.api python libraries are used in performing the analysis and the results showing the slope coefficient and the p-values are shown in Table 2.

In comparison to the findings of Maeenuddin *et al.*[12], which established a significant positive correlation between working capital management components and ROCE, our results present a nuanced picture. The regression analysis reveals slope coefficients represented by (r), alongside high p-values (p) for these coefficients, indicating a lack of statistical significance. Furthermore, the regression models exhibit diminished fit, as evidenced by non-normality of residuals indicated by Omnibus, Durbin-Watson, Jarque-Bera, Skew and Kurtosis values.

Table 3: Spearman correlation results

	Pre-pandemic		Pandemic		Post-pandemic	
Relationship	r	p	r	p	r	p
ART-ROCE	0.007	0.949	-0.193	0.065	0.055	0.609
AP-ROCE	0.100	0.989	-0.089	0.395	0.071	0.504
IT-ROCE	-0.152	0.148	-0.266	0.010	-0.057	0.591

r: Correlation coefficient and p: p-value

The findings of the study show that during the pre-pandemic period, a positive correlation between Accounts Receivable Turnover (ART) and ROCE (r = 0.116), with a significant p-value of 0.014, was observed. However, amidst the pandemic, this correlation reversed, becoming negative (r = -0.078), accompanied by a non-significant p-value of 0.472. Notably, in the post-pandemic phase, the positive correlation resurfaced (r = 0.077), exhibiting a highly significant p-value of 0.000. These fluctuations underscore the sensitivity of the ART-ROCE relationship to external economic factors.

Similarly, the correlation between Accounts Payable (AP) and ROCE demonstrated a strong positive association pre-pandemic (r = 0.083), with a highly significant p-value of 0.001. Amidst the pandemic, this correlation shifted to negative (r = -0.060), albeit with a non-significant p-value of 0.263. Post-pandemic, the positive correlation re-emerged (r = 0.047), with a highly significant p-value of 0.000. This pattern suggests a robust pre-pandemic connection, minimal pandemic impact and a reaffirmation of significance post-pandemic.

Furthermore, Inventory Turnover (IT) and ROCE exhibited a positive correlation pre-pandemic (r = 0.087), with a moderately significant p-value of 0.031. However, during the pandemic period, this correlation turned negative (r = -0.072), with a non-significant p-value of 0.467. In the post-pandemic phase, a return to positive correlation (r = 0.071) was observed, with a highly significant p-value of 0.000. This oscillating relationship suggests a responsive interplay between inventory turnover and return on capital employed, sensitive to prevailing economic conditions.

In summary, while the findings from this study demonstrate fluctuations in the direction and significance of the relationships between working capital management components and ROCE across different economic periods, they diverge from the significant positive correlation reported by Maeenuddin *et al.*[12]. These discrepancies highlight the complexity and variability inherent in these relationships, which may be influenced by contextual factors such as economic conditions, industry-specific dynamics and strategies employed by the firm.

Spearman correlation: In accordance with the outlined methodology, a Spearman Correlation analysis was conducted to examine non-linear associations among variables. The intriguing results of this test were presented in Table 3.

In contrast to the findings of Maeenuddin *et al.*[12], which established a significant positive correlation between working capital management components and ROCE, the results of this study present a different perspective. Across the examined time periods, the relationships between Accounts Receivable Turnover (ART) and ROCE, Accounts Payable (AP) and ROCE and Inventory Turnover (IT) and ROCE were characterized by weak correlations, with largely non-significant p-values.

In the pre-pandemic era of 2019, the ART-ROCE relationship exhibited a very weak positive correlation, which was non-significant. Transitioning into the pandemic period of 2020, a weak negative correlation emerged, although with a marginally significant p-value. Post-pandemic in 2021, the relationship returned to a weak positive correlation with a non-significant p-value. These results underscore the subtle and non-significant nature of the ART-ROCE relationship across the examined time periods. Similarly, the relationships between AP and ROCE and IT and ROCE, also demonstrated weak correlations with non-significant p-values across the pre-pandemic, pandemic and post-pandemic phases. While fluctuations in correlation strength were observed, particularly for IT and ROCE during the pandemic era, the overall trends remained weak and non-significant.

Overall, current findings diverge from those of Maeenuddin *et al.*[12] by highlighting the persistent non-significant nature of the relationships between working capital management components and ROCE across different economic periods. These results suggest that the ART-ROCE, AP-ROCE and IT-ROCE relationships may not exhibit the same level of significance or consistency as reported in prior studies. The nuanced and fluctuating nature of these relationships underscores the complexity of factors influencing operational efficiency and profitability, which may vary across different contexts and time periods.

CONCLUSION

Our thorough analysis of financial trends across different time frames sheds light on the complex interplay between working capital management and firm profitability, particularly ROCE. We observed consistent patterns in account payable turnover and inventory turnover, while account receivable turnover and ROCE exhibited greater variability, especially during the pandemic. Post-pandemic recovery in ROCE aligns with both the pecking order and trade-off theories, indicating improved profitability and careful use of internal funds during challenging times. However, our dual-model analyses revealed weak and non-significant correlations between working capital management components and ROCE across economic periods. Contrary to expectations, we found positive correlations between specific working capital components and ROCE, suggesting nuanced dynamics. Economic disruptions during the pandemic posed challenges to conservative and aggressive strategies, with non-significant relationships observed. Future research endeavors should explore these relationships while considering factors such as industry dynamics, location, company strategies and management decisions. The incorporation of alternative modeling approaches, such as kernel regression or the Python Transformer Library for artificial intelligence, has the capacity to yield more profound insights. A tri-model approach combining OLS regression, Spearman correlation and ARIMA model could offer a more comprehensive understanding of financial relationships. In summation, our findings contribute meaningfully to the ongoing discourse on the intricate dynamics between working capital management and firm profitability.

SIGNIFICANCE STATEMENT

This research provides valuable contributions to the ongoing discourse on working capital management and firm profitability. The study's comprehensive analysis of financial trends offers vital insights into the intricate relationship between working capital management and firm profitability. Contrary to expectations, positive correlations between specific working capital components and ROCE challenge conventional theories. Economic disruptions highlighted challenges in both conservative and aggressive strategies, underscoring the need for adaptable approaches. The study's findings, supported by diverse analytical models, contribute significantly to understanding financial dynamics.

REFERENCES

1. Abuhommous, A.A., A.S. Alsaraireh and H. Alqaralleh, 2022. The impact of working capital management on credit rating. Financ. Innovation, Vol. 8. 10.1186/s40854-022-00376-z.
2. Chishty, B., N.U.H. Ansari, A. Hussain and S. Fareed, 2022. Working capital management and corporate internal growth performance: Evidence of listed non-financial companies in Pakistan. Rev. Manage. Sci., 4: 95-107.
3. Ibrahim, U.A. and A. Isiaka, 2021. Working capital management and financial performance of non financial quoted companies in Nigeria. Int. J. Res. Bus. Social Sci., 10: 241-258.
4. Morshed, A., 2020. Role of working capital management in profitability considering the connection between accounting and finance. Asian J. Accounting Res., 5: 257-267.
5. Nwude, E.C., P.U. Allison and C.A. Nwude, 2021. The relationship between working capital management and corporate returns of cement industry of emerging market. Int. J. Finance Econ., 26: 3222-3235.
6. Burney, R.B., H.L. James and H. Wang, 2021. Working capital management and CEO age. J. Behav. Exp. Finance, Vol. 30. 10.1016/j.jbef.2021.100496.
7. Andriani, B., M. Nurnajamuddin and K. Rosyadah, 2021. Does profitability, firm size, and investment opportunity set affect earnings quality? J. Akuntansi, 25: 54-69.
8. Lyngstadaas, H., 2020. Packages or systems? Working capital management and financial performance among listed U.S. manufacturing firms. J. Manage. Control, 31: 403-450.
9. Yankovyi, O., L. Sotnychenko and A. Petrashevska, 2018. Determination of optimum of capital-labour ratio within two-factor production functions with non-zero substitution by the principle of equal margin. Baltic J. Econ. Stud., 4: 372-378.
10. Girma, A.M., 2020. The effects of working capital management on profitability of manufacturing companies: The case of Dire Dawa City. Sci. J. Bus. Manage., 7: 135-139.
11. Louw, E., J.H. Hall and R.P. Pradhan, 2022. The relationship between working capital management and profitability: Evidence from South African retail and construction firms. Global Bus. Rev., 23: 313-333.
12. Maeenuddin, L. Yusrini, S.A. Hamid, A.I. Khan and Ghayasuddin, 2021. Working capital management and firm's financial performance (ROCE). Turk. Online J. Qual. Inq., 12: 1848-1862.
13. Ahmad, M., R. Bashir and H. Waqas, 2022. Working capital management and firm performance: Are their effects same in COVID 19 compared to financial crisis 2008? Cogent Econ. Finance, Vol. 10. 10.1080/23322039.2022.2101224.
14. Alsulayhim, N.A., 2019. The relationship between working capital management and profitability. Int. Bus. Res., 12: 142-152.

15. Reyad, H.M., M.A. Zariyawati, T.S. Ong and H. Muhamad, 2022. The impact of macroeconomic risk factors, the adoption of financial derivatives on working capital management and firm performance. Sustainability, Vol. 14. 10.3390/su142114447.
16. Stewart, C., 2021. Staying alive: Leadership in COVID-19 world. J. Leadersh. Account. Ethics, 18: 86-92.
17. Tarkom, A., 2022. Impact of COVID-19 exposure on working capital management: The moderating effect of investment opportunities and government incentives. Finance Res. Lett., Vol. 47. 10.1016/j.frl.2021.102666.
18. Asaolu, A.A., 2021. Capital structure and firm performance: A comparative study of oil & gas and manufacturing sectors in the United States of America. Bus. Manage. Stud., 7: 29-44.
19. Salinger, R.M., H.S. Morisson and A.K. Hemingway, 2022. First-order determinants of capital structure among listed manufacturing companies in the United States of America. J. Finance Accounting, 6: 1-14.
20. Prempeh, K.B. and G. Peprah-Amankona, 2020. Does working capital management affect profitability of Ghanaian manufacturing firms? Zagreb Int. Rev. Econ. Bus., 23: 1-18.
21. Sawarni, K.S., S. Narayanasamy and K. Ayyalusamy, 2021. Working capital management, firm performance and nature of business: An empirical evidence from India. Int. J. Prod. Perform. Manage., 70: 179-200.
22. Venkatachalam, K. and S. Kavitha, 2021. Imapct of working capital management on profitability of the select commercial vehicle manufacturers in India. Ann. Rom. Soc. Cell Biol., 25: 3471-3481.
23. Agegnew, A., 2019. The effect of working capital management on profitability: The case of selected manufacturing and merchandising companies in Hawassa City administration. Res. J. Finance Accounting, 10: 51-85.
24. Pirttilä, M., V.M. Virolainen, L. Lind and T. Kärri, 2020. Working capital management in the Russian automotive industry supply chain. Int. J. Prod. Econ., Vol. 221. 10.1016/j.ijpe.2019.08.009.
25. Lisek, S., L. Luty and M. Zioło, 2020. Measurement of capital profitability as an element of assessing the financial condition of an enterprise. Sci. J. Małopolska Univ. Econ. Tarnów, 46: 55-67.
26. Ahangar, N., 2021. Is the relationship between working capital management and firm profitability non-linear in Indian SMEs? Small Enterp. Res., 28: 23-35.
27. Chambers, N. and A. Cifter, 2022. Working capital management and firm performance in the hospitality and tourism industry. Int. J. Hospitality Manage., Vol. 102. 10.1016/j.ijhm.2022.103144.
28. Akomeah, J. and S. Frimpong, 2019. Effect of working capital management on profitability of listed manufacturing companies in Ghana. Int. J. Finance Banking Res., 5: 29-35.
29. Mizenur Rahaman, M., M. Zillur Rahman, S.T.M. Hasan and M. Roy, 2021. Impact of working capital management on organizational performance: Evidence from small enterprises of Bangladesh. Int. J. Manage. Accounting Econ., 8: 195-212.
30. Xu, D., C. Gan, Z. Li and P. Wang, 2021. Earnings, working capital and dividend payout: Evidence from the London stock exchange. Ann. Econ. Finance, 22: 421-449.
31. EL-Ansary, O. and H. Al-Gazzar, 2021. Working capital and financial performance in MENA region. J. Hum. Appl. Social Sci., 3: 257-280.
32. Mandipa, G. and A.B. Sibindi, 2022. Financial performance and working capital management practices in the retail sector: Empirical evidence from South Africa. Risks, Vol. 10. 10.3390/risks10030063.
33. Elberzhager, F., J. Münch and V.T.N. Nha, 2012. A systematic mapping study on the combination of static and dynamic quality assurance techniques. Inf. Software Technol., 54: 1-15.
34. Zheng, X., Y. Zhou and S. Iqbal, 2022. Working capital management of SMEs in COVID-19: Role of managerial personality traits and overconfidence behavior. Econ. Anal. Policy, 76: 439-451.
35. Wang, Z., M. Akbar and A. Akbar, 2020. The interplay between working capital management and a firm's financial performance across the corporate life cycle. Sustainability, Vol. 12. 10.3390/su12041661.
36. Ganc, M., 2020. Working capital management strategy and selected measures of financial security for dairy cooperatives in Poland. Acta Sci. Polonorum Oeconomia, 19: 33-40.
37. Banerjee, P., S. Dutta and P. Zhu, 2021. Multidimensionality of text based financial constraints and working capital management. Int. Rev. Financ. Anal., Vol. 77. 10.1016/j.irfa.2021.101866.
38. Panda, A.K., S. Nanda and P. Panda, 2021. Working capital management, macroeconomic impacts, and firm profitability: Evidence from Indian SMEs. Bus. Perspect. Res., 9: 144-158.
39. Kerem, S. and B. Sargon, 2021. The working capital management on the corporate profitability of listed firms: Evidence from credit ratings on FTSE 100 companies. J. Econ. Public Finance Bus., 4: 145-154.
40. Khan, A., R.M.S. Yaqub and A. Javeed, 2021. Mediating role of working capital management in the relationship of corporate governance measures and firm performance: Panel study from Pakistan. J. Accounting Finance Emerging Econ., 7: 281-294.
41. Nastiti, P.K.Y., A.D.R. Atahau and S. Supramono, 2019. Working capital management and its influence on profitability and sustainable growth. Bus.: Theory Pract., 20: 61-68.
42. Obeng, H., B.K. Enos and J. Yensu, 2021. Working capital management, working capital policy and firm performance in Ghana: Empirical evidence using a dynamic system GMM. Afr. J. Bus. Econ. Res., 16: 249-271.

43. Tasavori, M., N. Eftekhar, G.M. Elyasi and R. Zaefarian, 2021. Human resource capabilities in uncertain environments. Int. J. Hum. Resour. Manage., 32: 3721-3747.
44. Utama, C. and R. Meilianna, 2020. The role of monetary policy in comparative advantage and trade balance of capital intensive industry in Indonesia. Econ. Reg., 16: 298-309.
45. Bonaventure, O.C., J.A.R. Chitom and E.R. Asika, 2019. Effect of financial mix on profitability of quoted beverage firms in Nigeria. Int. J. Accounting Finance Risk Manage., 4: 102-109.
46. Widyawati, N.L. and M.N. Ningtyas, 2022. Analysis of financial performance and share performance before and after the COVID-19 pandemic on the IDX. J. Ilmiah Bisnis Ekonomi Asia, 16: 292-307.
47. Bosman, L., N. Hartman and J. Sutherland, 2020. How manufacturing firm characteristics can influence decision making for investing in Industry 4.0 technologies. J. Manuf. Technol. Manage., 31: 1117-1141.
48. Hossain, M.R. and M.A. Zariyawati, 2022. Uncertainty in working capital management and firm performance: A COVID-19 perspective. Int. J. Econ. Manage., 16: 117-130.
49. Simon, S., N. Sawandi, S. Kumar and M. El-Bannany, 2021. Economic downturns and working capital management practices: A qualitative enquiry. Qual. Res. Financ. Mark., 13: 529-547.
50. Wadesango, O., V. Jones, L. Sitsha and N. Wadesango, 2022. The impact of COVID-19 lockdown on working capital management and profitability of firms: A case study of lesley bakers PVT LTD. Int. J. Econ. Financ. Issues, 12: 78-85.
51. Braimah, A., Y. Mu, I. Quaye and A.A. Ibrahim, 2021. Working capital management and SMEs profitability in emerging economies: The Ghanaian case. SAGE Open, Vol. 11. 10.1177/2158244021989317.
52. Jaworski, J. and L. Czerwonka, 2022. Profitability and working capital management: Evidence from the Warsaw stock exchange. J. Bus. Econ. Manage., 23: 180-198.
53. Ren, T., N. Liu, H. Yang, Y. Xiao and Y. Hu, 2019. Working capital management and firm performance in China. Asian Rev. Accounting, 27: 546-562.
54. Chaklader, B. and B. Padmapriya, 2021. Impact of cash surplus on firm's capital structure: Validation of pecking order theory. Managerial Finance, 47: 1801-1816.
55. Oktavina, M. and S. Manalu, 2018. Pecking order and trade-off theory in capital structure analysis of family firms in Indonesia. J. Keuangan Perbankan, 22: 73-82.
56. Myers, S.C., 1984. The capital structure puzzle. J. Finance, 39: 574-592.
57. Agyei, J., S. Sun and E. Abrokwah, 2020. Trade-off theory versus pecking order theory: Ghanaian evidence. SAGE Open, Vol. 10. 10.1177/2158244020940987.
58. Epong, M.I.K. and P.I.B. Anom, 2019. Capital structure variables of pecking order theory perspective in Indonesia stock exchange. Russ. J. Agric. Socio-Econ. Sci., 11: 111-121.
59. Nguyen, H.M., T.H.G. Vuong, T.H. Nguyen, Y.C. Wu and W.K. Wong, 2020. Sustainability of both pecking order and trade-off theories in Chinese manufacturing firms. Sustainability, Vol. 12. 10.3390/su12093883.
60. Nyeadi, J.D., Y.A. Sare and G. Aawaar, 2018. Determinants of working capital requirement in listed firms: Empirical evidence using a dynamic system GMM. Cogent Econ. Finance, Vol. 6. 10.1080/23322039.2018.1558713.
61. Boisjoly, R.P., T.E. Conine and M.B. McDonald, 2020. Working capital management: Financial and valuation impacts. J. Bus. Res., 108: 1-8.
62. Moraffah, R., P. Sheth, M. Karami, A. Bhattacharya and Q. Wang *et al*., 2021. Causal inference for time series analysis: Problems, methods and evaluation. Knowl. Inf. Syst., 63: 3041-3085.
63. Deng, J., Y. Deng and K.H. Cheong, 2021. Combining conflicting evidence based on Pearson correlation coefficient and weighted graph. Int. J. Intell. Syst., 36: 7443-7460.
64. Sedgwick, P., 2014. Spearman's rank correlation coefficient. BMJ, Vol. 349. 10.1136/bmj.g7327.
65. Song, H.Y. and S. Park, 2020. An analysis of correlation between personality and visiting place using spearman's rank correlation coefficient. KSII Trans. Internet Inf. Syst., 14: 1951-1966.
66. Lestari, A., F.E. Supriatin and A.E. Harjanti, 2022. The effect of account receivable turnover and cash turnover on liquidity at PT PLN Persero. AKUMULASI: Indones. J. Appl. Accounting Finance, 1: 13-23.
67. Nuraini, A.I., 2021. The effect of cash turnover and inventory turnover on return on assets (ROA). Almana: J. Manajemen Bisnis, 5: 259-270.
68. Blendinger, G. and G. Michalski, 2018. Value add financial measures used by German dax 30 corporations as part of highly professionalized corporate governance management. Rev. Innovation Competitiveness J. Econ. Social Res., 4: 73-98.
69. Singh, J. and P. Yadav, 2013. Return on capital employed-A tool for analyzing profitability of companies. Int. J. Techno-Manage. Res., Vol. 1.
70. Singh, P., 2020. Intelligent portfolio management via NLP analysis of financial 10-k statements. Int. J. Techno-Manage. Res., 11: 13-25.
71. Awad, I. and F. Jayya, 2013. Working capital management, liquidity and profitability of the manufacturing sector in Palestine: Panel co-integration and causality. Mod. Econ., 4: 662-671.